

AMENDMENTS TO THE CLAIMS

1-53. (Canceled).

54. (Currently Amended) A catalytic composition for upgrading high molecular weight hydrocarbons comprising an admixture of water and the reaction products of particles of the following components:

- i. about 15 to 35 weight percent silicon dioxide,
- ii. about 1 to 6 weight percent aluminum oxide,
- iii. about 5 to 20 weight percent ferric oxide,
- iv. about 10 to 30 weight percent calcium oxide,
- v. at least about 2 weight percent titanium dioxide or boron oxide, and
- vi. at least about 8 weight percent transition metal salt[[,]];

the weight percents being based on the total weight of components (i) - (vi), and the composition comprises up to 50 weight percent C₅ to C₂₅ alkane or cycloalkane, based on the total weight of the composition.

55. (Currently Amended) The composition of claim ~~53~~54, wherein the C₅ to C₂₅ alkane or cycloalkane is diesel fuel or naphtha.

56. (Currently Amended) The catalytic composition of claim ~~52~~54, wherein the transition metal salt is one or more of the compounds selected from ferric halides, cupric halides, cobalt halides, and ferrous halides.

57. (Currently Amended) An admixture of a high molecular weight hydrocarbon and the catalytic composition of claim ~~52~~54 wherein the weight ratio of the high molecular weight hydrocarbon to the catalytic composition is from 2:1 to 4:1.

58. (Previously Presented) The admixture of claim 57 wherein the high molecular weight hydrocarbon composition is one or more components selected from bitumens, asphaltenes, oils, and tars.

59-60. (Canceled).

61. (Currently Amended) A catalytic composition comprising an admixture of water and the reaction products of particles of a cement component, a volcanic ash component, a transition metal salt, and titanium dioxide or boron oxide, wherein the weight percents of the components are as follows:

- i. 30 to 50 weight percent cement component,
- ii. 30 to 50 weight percent volcanic ash component,
- iii. at least 2 weight percent titanium dioxide or boron oxide, and
- iv. at least 8 weight percent transition metal salt[[,]];

the weight percents being based on the total weight of components (i) - (iv), and the composition comprises up to 50 weight percent C₅ to C₂₅ alkane or cycloalkane, based on the total weight of the composition.

62. (Currently Amended) The composition of claim ~~60~~61, wherein the C₅ to C₂₅ alkane or cycloalkane is diesel fuel or naphtha.

63. (Currently Amended) The catalytic composition of claim ~~59~~61, wherein the cement component is Portland cement.

64. (Currently Amended) The catalytic composition of claim ~~59~~61, wherein the volcanic ash component is one or more components selected from scoria, basalt, pyroclastic rock, tuff, tuffstone, volcanic glass, pumice, mafic rock, ultramafic rock, and silicate-based zeolites.

65. (Currently Amended) The catalytic composition of claim 5961, wherein the transition metal salt is one or more of the compounds selected from ferric halides, cupric halides, cobalt halides, and ferrous halides.

66. (Previously presented) A catalytic composition comprising an admixture of water and the reaction products of particles of a cement component, a volcanic ash component, a transition metal salt, and titanium dioxide or boron oxide, wherein the particles have a Blaine surface area to weight ratio of at least $3000 \text{ cm}^2/\text{gm}$, the volcanic ash component is scoria or a mixture of scoria and basalt, the transition metal salt is ferric chloride and the catalytic composition comprises at least 2 weight percent of titanium dioxide.

67. (Currently Amended) An admixture of a high molecular weight hydrocarbon and the catalytic composition of claim 5966, wherein the weight ratio of the high molecular weight hydrocarbon to the catalytic composition is from 2:1 to 4:1.

68. (Previously Presented) The admixture of claim 67, wherein the high molecular weight hydrocarbon composition is one or more components selected from bitumens, asphaltenes, oils, and tars.

69. (Canceled).

70. (Currently Amended) A method of making a catalytic composition for the upgrading of a high molecular weight hydrocarbon composition which comprises:

(a) admixing particles having a Blaine surface area to weight ratio of at least $3000 \text{ cm}^2/\text{gm}$ of silicon dioxide, aluminum oxide, ferric oxide, calcium oxide, titanium dioxide or boron oxide, and a transition metal salt; and

(b) blending the admixture with water,

wherein the weight percents of the components are as follows:

- i. about 15 to 35 weight percent silicon dioxide,
- ii. about 1 to 6 weight percent aluminum oxide,

- iii. about 5 to 20 weight percent ferric oxide,
- iv. about 10 to 30 weight percent calcium oxide,
- v. at least about 2 weight percent titanium dioxide or boron oxide, and
- vi. at least about 8 weight percent transition metal salt[[],];

the weight percents being based on the total weight of components (i) - (vi).

71. (Currently Amended) The method of claim 6970, wherein the transition metal salt is one or more of the compounds selected from ferric halides, cupric halides, cobalt halides, and ferrous halides.

72. (Canceled).

73. (Currently Amended) The method of claim 6970, further including blending the admixture with a C₅ to C₂₅ alkane or cycloalkane.

74. (Previously Presented) The method of claim 73, wherein the admixture is blended with up to 50 weight percent C₅ to C₂₅ alkane or cycloalkane, based on the total weight of the admixture and the C₅ to C₂₅ alkane or cycloalkane.

75. (Previously Presented) The method of claim 73, wherein the C₅ to C₂₅ alkane or cycloalkane is diesel fuel or naphtha.

76. (Canceled).

77. (Currently Amended) ~~The method of claim 76, wherein the weight percents of the components are as follows~~ A method of making a catalytic composition for the upgrading of a high molecular weight hydrocarbon composition which comprises

(a) admixing particles of the following components having a Blaine surface area to weight ratio of at least 3000 cm²/gm:

- i. about 30 to 50 weight percent cement component,
- ii. about 30 to 50 weight percent volcanic ash component,

- iii. at least about 2 weight percent titanium dioxide or boron oxide, and
 - iv. at least about 8 weight percent transition metal salt,
- the weight percents being based on the total weight of components (i) - (iv)[[.]]; and
- (b) blending the admixture with water.

78. (Currently Amended) The method of claim ~~7677~~, wherein the cement component is Portland cement.

79. (Currently Amended) The method of claim ~~7677~~, wherein the volcanic ash component is one or more components selected from scoria, basalt, pyroclastic rock, tuff, tuffstone, volcanic glass, pumice, mafic rock, ultramafic rock, and silicate-based zeolites.

80. (Currently Amended) The method of claim ~~7677~~, wherein the transition metal salt is one or more of the compounds selected from ferric halides, cupric halides, cobalt halides, and ferrous halides.

81. (Canceled).

82. (Currently Amended) The method of claim ~~7677~~, further including blending the admixture with a C₅ to C₂₅ alkane or cycloalkane.

83. (Previously Presented) The method of claim 82, wherein the C₅ to C₂₅ alkane or cycloalkane is diesel fuel or naphtha.

84. (Previously Presented) The method of claim 82, wherein the admixture is blended with up to 50 weight percent C₅ to C₂₅ alkane or cycloalkane, based on the total weight of the admixture and the C₅ to C₂₅ alkane or cycloalkane.

85. (Currently Amended) A method of cracking a high molecular weight hydrocarbon composition to form a lower molecular weight hydrocarbon product, comprising:

(a) contacting, in the liquid phase, ~~the a~~ catalytic composition of ~~claim 52~~ with a high molecular weight hydrocarbon to hydrogenate and crack the high molecular weight hydrocarbon; and

(b) recovering the lower molecular weight hydrocarbon product formed in step (a), the lower molecular weight product having an average API value greater than the API value of the high molecular weight hydrocarbon composition;
wherein said catalytic composition comprises an admixture of water and the reaction products of particles of the following components: silicon dioxide, aluminum oxide, ferric oxide, calcium oxide, titanium dioxide or boron oxide, and a transition metal salt, wherein the particles have a Blaine surface area to weight ratio of at least 3000 cm²/gm.

86. (Previously Presented) The method of claim 85, wherein the high molecular weight hydrocarbon composition is one or more components selected from bitumens, asphaltenes, oils, and tars.

87. (Previously Presented) The method of claim 85, wherein the weight ratio of the high molecular weight hydrocarbon to the catalytic composition is from 2:1 to 4:1.

88. (Currently Amended) A method of cracking a high molecular weight hydrocarbon composition to form a lower molecular weight hydrocarbon product, comprising:

(a) contacting a catalytic composition with a high molecular weight hydrocarbon at ambient temperature and pressure to hydrogenate and crack the high molecular weight hydrocarbon; and

(b) recovering the lower molecular weight hydrocarbon product formed in step (a), the lower molecular weight product having an average API value greater than the API value of the high molecular weight hydrocarbon composition[.];
wherein said catalytic composition comprises an admixture of water and the reaction products of particles of the following components: silicon dioxide, aluminum oxide, ferric oxide, calcium oxide, titanium dioxide or boron oxide, and a transition metal salt, said particles having a Blaine surface area to weight ratio of at least 3000 cm²/gm.

89. (Currently Amended) A method of cracking a high molecular weight hydrocarbon composition to form a lower molecular weight hydrocarbon product, comprising:

(a) contacting, in the liquid phase, the composition of claim 54 with a high molecular weight hydrocarbon to hydrogenate and crack the high molecular weight hydrocarbon; and

(b) recovering the lower molecular weight hydrocarbon product formed in step (a)[[.]];

the lower molecular weight product having an average API value greater than the API value of the high molecular weight hydrocarbon composition.

90. (Previously Presented) The method of claim 89, wherein the high molecular weight hydrocarbon composition is one or more components selected from bitumens, asphaltenes, oils, and tars.

91. (Previously Presented) The method of claim 89, wherein the weight ratio of the high molecular weight hydrocarbon to the catalytic composition is from 2:1 to 4:1.

92. (Currently Amended) A method of cracking a high molecular weight hydrocarbon composition to form a lower molecular weight hydrocarbon product, comprising:

(a) contacting a catalytic composition with a high molecular weight hydrocarbon at ambient temperature and pressure to hydrogenate and crack the high molecular weight hydrocarbon; and

(b) recovering the lower molecular weight hydrocarbon product formed in step (a), the lower molecular weight product having an average API value greater than the API value of the high molecular weight hydrocarbon composition[[.]];

wherein said catalytic composition comprises an admixture of water and the reaction products of particles of the following components: silicon dioxide, aluminum oxide, ferric oxide, calcium oxide, titanium dioxide or boron oxide, and a transition metal salt, said particles having a Blaine surface area to weight ratio of at least 3000 cm²/gm and the weight percents of the components are as follows:

- i. about 15 to 35 weight percent silicon dioxide,
- ii. about 1 to 6 weight percent aluminum oxide,
- iii. about 5 to 20 weight percent ferric oxide,
- iv. about 10 to 30 weight percent calcium oxide,
- v. at least about 2 weight percent titanium dioxide or boron oxide, and
- vi. at least about 8 weight percent transition metal salt[$[L]$];

said weight percents being based on the total weight of components (i) - (vi), and the catalytic composition comprises up to 50 weight percent C_5 to C_{25} alkane or cycloalkane, based on the total weight of the catalytic composition.

93. (Currently Amended) A method of cracking a high molecular weight hydrocarbon composition to form a lower molecular weight hydrocarbon product, comprising:

(a) contacting, in the liquid phase, ~~the a~~ catalytic composition of ~~claim 59~~ with a high molecular weight hydrocarbon to hydrogenate and crack the high molecular weight hydrocarbon; and

(b) recovering the lower molecular weight hydrocarbon product formed in step (a), ~~the lower molecular weight product having an average API value greater than the API value of the high molecular weight hydrocarbon composition;~~

wherein said catalyst composition comprises an admixture of water and the reaction products of particles of a cement component, a volcanic ash component, a transition metal salt, and titanium dioxide or boron oxide, wherein the particles have a Blaine surface area to weight ratio of at least 3000 cm²/gm.

94. (Previously Presented) The method of claim 93, wherein the high molecular weight hydrocarbon composition is one or more components selected from bitumens, asphaltenes, oils, and tars.

95. (Previously Presented) The method of claim 93, wherein the weight ratio of the high molecular weight hydrocarbon to the catalytic composition is from 2:1 to 4:1.

96. (Currently Amended) A method of cracking a high molecular weight hydrocarbon composition to form a lower molecular weight hydrocarbon product, comprising:

(a) contacting a catalytic composition with a high molecular weight hydrocarbon at ambient temperature and pressure to hydrogenate and crack the high molecular weight hydrocarbon; and

(b) recovering the lower molecular weight hydrocarbon product formed in step (a), the lower molecular weight product having an average API value greater than the API value of the high molecular weight hydrocarbon composition[[.]]; wherein said catalytic composition comprises an admixture of water and the reaction products of particles of a cement component, a volcanic ash component, a transition metal salt, and titanium dioxide or boron oxide, said particles having a Blaine surface area to weight ratio of at least 3000 cm²/gm.

97. (Previously presented) A method of cracking a high molecular weight hydrocarbon composition to form a lower molecular weight hydrocarbon product, comprising:

(a) contacting, in the liquid phase, the composition of claim 61 with a high molecular weight hydrocarbon to hydrogenate and crack the high molecular weight hydrocarbon; and

(b) recovering the lower molecular weight hydrocarbon product formed in step (a), the lower molecular weight product having an average API value greater than the API value of the high molecular weight hydrocarbon composition.

98. (Previously Presented) The method of claim 97, wherein the high molecular weight hydrocarbon composition is one or more components selected from bitumens, asphaltenes, oils, and tars.

99. (Previously Presented) The method of claim 97, wherein the weight ratio of the high molecular weight hydrocarbon to the catalytic composition is from 2:1 to 4:1.

100. (Currently Amended) A method of cracking a high molecular weight hydrocarbon composition to form a lower molecular weight hydrocarbon product, comprising:

(a) contacting a composition with a high molecular weight hydrocarbon at ambient temperature and pressure to hydrogenate and crack the high molecular weight hydrocarbon; and

(b) recovering the lower molecular weight hydrocarbon product formed in step (a), the lower molecular weight product having an average API value greater than the API value of the high molecular weight hydrocarbon composition[.];

wherein said composition comprises an admixture of water and the reaction products of particles of a cement component, a volcanic ash component, a transition metal salt, and titanium dioxide or boron oxide, said particles having a Blaine surface area to weight ratio of at least 3000 cm²/gm and the weight percents of the components are as follows:

- i. 30 to 50 weight percent cement component,
- ii. 30 to 50 weight percent volcanic ash component,
- iii. at least 2 weight percent titanium dioxide or boron oxide, and
- iv. at least 8 weight percent transition metal salt[.];

said weight percents being based on the total weight of components (i) - (iv), and the composition further comprises a C₅ to C₂₅ alkane or cycloalkane in an amount up to 50 weight percent, based on the total weight of the composition.

101-104. (Canceled).

105. (Previously Presented) A catalytic composition comprising an admixture of water and the reaction products of particles of a (i) cement component, (ii) a volcanic ash component comprising scoria or a mixture of scoria and basalt, (iii) a transition metal salt, and (iv) titanium dioxide or boron oxide, wherein the particles have a Blaine surface area to weight ratio of at least 3000 cm²/gm.

106. (Previously Presented) A method of making a catalytic composition for the upgrading of a high molecular weight hydrocarbon composition which comprises:

- (a) admixing particles having a Blaine surface area to weight ratio of at least $3000 \text{ cm}^2/\text{gm}$ of (i) a cement component, (ii) a volcanic ash component comprising scoria or a mixture of scoria and basalt, (iii) a transition metal salt, and (iv) titanium dioxide or boron oxide; and
- (b) blending the admixture with water.

107. (Previously Presented) A method of cracking a high molecular weight hydrocarbon composition to form a lower molecular weight hydrocarbon product, comprising:

- (a) contacting (i) a catalytic composition comprising an admixture of water and the reaction products of (A) particles of a cement component, (B) a volcanic ash component comprising scoria or a mixture of scoria and basalt, (C) a transition metal salt, and (D) titanium dioxide or boron oxide, wherein the particles have a Blaine surface area to weight ratio of at least $3000 \text{ cm}^2/\text{gm}$ with (ii) a high molecular weight hydrocarbon to hydrogenate and crack the high molecular weight hydrocarbon; and
- (b) recovering the lower molecular weight hydrocarbon product formed in step (a),

the lower molecular weight product having an average API value greater than the API value of the high molecular weight hydrocarbon composition.

108. (Currently Amended) A method of cracking a high molecular weight hydrocarbon composition to form a lower molecular weight hydrocarbon product, comprising:

- (a) contacting a catalytic composition comprising an admixture of water and the reaction products of particles of:
 - i. 30 to 50 weight percent of a cement component,
 - ii. 30 to 50 weight percent of scoria or a mixture of scoria and basalt,
 - iii. at least 2 weight percent of titanium dioxide or boron oxide,
 - iv. at least 8 weight percent of transition metal salt[$[\text{I}, \text{II}]$];

the weight percents being based on the total weight of components (i) - (iv), wherein the particles of a Blaine surface area to weight ratio of at least $300\text{cm}^2/\text{gm}$, and up to 50 weight percent of C_5 to C_{25} alkane or cycloalkane, based on the total weight of the composition, with a high molecular weight hydrocarbon to hydrogenate and crack the high molecular weight hydrocarbon; and

(b) recovering the lower molecular weight hydrocarbon product formed in step (a)[[.]],

the lower molecular weight product having an average API value greater than the API value of the high molecular weight hydrocarbon composition.

109. (New) A method of cracking a high molecular weight hydrocarbon composition to form a lower molecular weight hydrocarbon product, comprising:

(a) contacting a catalytic composition with a high molecular weight hydrocarbon at ambient temperature and pressure to hydrogenate and crack the high molecular weight hydrocarbon; and

(b) recovering the lower molecular weight hydrocarbon product formed in step (a), the lower molecular weight product having an average API value greater than the API value of the high molecular weight hydrocarbon composition;

wherein said catalyst composition comprising an admixture of water and the reaction products of the particles on the fine components: silicon dioxide, aluminum oxide, ferric oxide, calcium oxide, titanium dioxide or boron oxide, and a transition metal salt, wherein the particles have a Blaine surface area to weight ratio of at least $3000\text{ cm}^2/\text{gm}$.